CLAIMS

1. A membrane electrode assembly for a polymer electrolyte fuel cell, comprising:

a polymer electrolyte membrane; and

an anode and a cathode each having a catalytic layer and a diffusion layer,

the anode diffusion layer further comprising:

a carbon-based material; and

a water holding layer thereon containing water holding material for 5 to 20 wt% of total weight of an electron conductive material and the water holding material, or carbon particles having water absorption amount at saturated water vapor pressure at 60°C of not less than 150 cc/g,

wherein water absorption ratio of the anode diffusion layer at 60°C is in a range of 40 to 85%,

wherein a differential pressure measured by the differential pressure measuring method is in a range of 60 to 120 mmaq, and

wherein a ratio of quantity of electric charge of catalytic material of the cathode catalytic layer existing in proton conductive passage from the polymer electrolyte membrane measured by a cyclic voltammetric method is not less than 15% of the quantity of electric charge of all the catalytic material existing in the cathode catalytic layer.

2. The membrane electrode assembly for a polymer electrolyte fuel cell according to claim 1, wherein the anode diffusion layer comprises:

a carbon-based material;

a layer thereon having carbon particles and fluorine resin; and

a layer thereon having carbon particles, a polymer electrolyte, void

forming agent, and water holding material.

3. The membrane electrode assembly for a polymer electrolyte fuel cell according to claim 1, wherein the anode diffusion layer comprises:

a carbon-based material;

a layer thereon having carbon particles, fluorine resin, and water holding material.

4. A membrane electrode assembly for a polymer electrolyte fuel cell, comprising:

a polymer electrolyte membrane; and

an anode and a cathode each having a catalytic layer and a diffusion layer,

the anode diffusion layer further comprising:

a carbon-based material having a contact angle with water of not more than 90° by performing a hydrophilic treatment; and

a layer thereon having carbon particles having water absorption amount at saturated water vapor pressure at 60°C of not less than 150 cc/g and fluorine resin,

wherein water absorption ratio of the anode diffusion layer at 60°C is in a range of 40 to 85%,

wherein penetration resistance measured by a penetration resistance method is not more than 5 mΩ,

wherein a differential pressure measured by the differential pressure measuring method is in a range of 60 to 120 mmaq, and

wherein a ratio of quantity of electric charge of catalytic material of the cathode catalytic layer existing in proton conductive passage from the polymer electrolyte membrane measured by a cyclic voltammetric method

is not less than 15% of the quantity of electric charge of all the catalytic material existing in the cathode catalytic layer.

5. A membrane electrode assembly for a polymer electrolyte fuel cell, comprising:

a polymer electrolyte membrane; and

an anode and a cathode each having a catalytic layer and a diffusion layer,

the catalytic layer comprising:

at least a catalyst;

carbon particles supporting the catalyst; and

polymer electrolyte,

the cathode catalytic layer further contains void forming agent,

the diffusion layer comprising:

a carbon-based material; and

a layer thereon containing carbon particles and fluorine resin,

wherein water absorption amount at saturated water vapor pressure at 60°C of the carbon particles of the anode diffusion layer is not less than 150 cc/g and water absorption amount at saturated water vapor pressure at 60°C of the carbon particles of the cathode diffusion layer is less than 150 cc/g,

wherein water absorption ratio of the anode diffusion layer at 60°C is in a range of 40 to 85%,

wherein a differential pressure of the anode diffusion layer and the cathode diffusion layer measured by the differential pressure measuring method is in a range of 60 to 120 mmaq and penetration resistance measured by a penetration resistance method is not more than 5mΩ, and

wherein a ratio of quantity of electric charge of catalytic material of

the cathode catalytic layer existing in proton conductive passage from the polymer electrolyte membrane measured by a cyclic voltammetric method is not less than 15% of the quantity of electric charge of all the catalytic material existing in the cathode catalytic layer.

6. The membrane electrode assembly for a polymer electrolyte fuel cell according to claim 5, wherein the carbon-based material of the anode diffusion layer has contact angle with water of not more than 90° by performing a hydrophilic treatment, and the carbon-based material of the cathode diffusion layer has a contact angle with water of not less than 130° by performing a water-repellent treatment.